

**BIOSTACK**  
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Orbiting spacecrafts are embedded in a complex environment consisting of electromagnetic radiation and of charged particles of solar and galactic origin, as well as of charged particles of the radiation belts and neutrons which result as an interaction production of the galactic radiation with the Earth's atmosphere.

The Biostack experiments address especially the biological effects of the galactic particles of high atomic number and high energy, called HZE particles. The objective of the experiments is to substantiate the assessment of spaceflight radiation hazard especially regarding these particles.

Experiments conducted during Apollo 16 and 17, Apollo-Soyuz, and Spacelab 1 missions demonstrated that the very high local concentration of absorbed energy delivered by single particles can have serious biological effects on an organism and that the seriousness of that damage is related to the organism's ability to repair or replace affected cells. The IML-1 Biostack investigation builds on the results of these earlier investigations, using advanced methods of dosimetry and exposing new biological samples and detectors.

Proper biological dosimetry of cosmic HZE particles is necessary to determine the effects of single heavy ions on individual biological test organisms. This is achieved by suitable combinations of physical visual particle detectors to which test organisms are attached in monolayers by various established techniques so that the spatial relation between the particles' trajectories and the affected cells can be read together with the biological response to the particles' passage. Radiation detectors to be utilized are nuclear emulsion and plastic detectors. Multiple detector sheets and biological monolayers are arranged in a sandwich-like manner. The resulting stacks are housed in hermetically-sealed cylindrical aluminum boxes. The biological test systems are Bacillus subtilis, Saccharomyces cerevisiae and Sordaria fimicola spores, Arabidopsis thaliana seeds, and Artemia salina eggs. Biological effects under investigation are inactivation, mutation induction, repair deficiencies, and developmental studies. Three boxes are located in two Spacelab racks, and one is under the floor to measure radiation doses in different areas of the laboratory.

Postflight processing of the particle detectors will reveal the particles' tracks and the biological response of the affected cells by various established techniques adapted to a given detector/cell combination.

The Biostack data will be used to calculate the potential hazards of cosmic rays to humans and biological experiments during spaceflight. Parts of the shuttle that are particularly vulnerable to radiation will be identified so that better radiation protection can be developed for those areas. Additionally, the science of radiation biology will benefit from a better understanding of the action of these particles on biological matter.